

CLAIMS

What is claimed is:

1. A method for calibrating a semi-empirical process simulator, said method comprising:

5 deriving a set of test conditions for which a profile evolution is governed only by a limited number of parameters;

selecting a plurality of test values for each said set of test conditions;

subjecting a test substrate to a test process defined by said plurality of test values, thereby creating a test surface profile;

10 generating an approximate profile prediction from said plurality of test values;

adjusting said plurality of test values to minimize a discrepancy between said test surface profile and said approximate profile prediction, thereby solving for said limited number of parameters; and

15 repeating said selecting, subjecting, generating, and adjusting for another said set of test conditions until said plurality of parameters is determined, thereby providing a final model of said profile evolution in terms said plurality of parameters.

20 2. The method of claim 1, wherein said profile evolution comprises an etch rate, a deposition rate, and a surface profile.

3. The method of claim 1, wherein generating said approximate profile prediction includes using a plurality of preliminary test values.

4. The method of claim 3, wherein said adjusting said plurality of test values includes changing at least one preliminary test value.

5. The method of claim 4, further comprising comparing said test surface profile and said approximate profile prediction.

10 6. The method of claim 5, further comprising incorporating at least one changed preliminary test value.

15 7. The method of claim 1, wherein said semi-empirical process simulator is used to determine a plurality of parameters governing a plasma process for creating a desired surface profile on a process substrate.

8. The method of claim 7, further comprising generating a plurality of parameters from said final model and said desired surface profile.

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~~9.~~ The method of claim 1, wherein said semi-empirical process simulator is used to predict a surface profile to be created on a process substrate by a plasma process defined by a plurality of parameters.

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a 10. The method of claim 8, further comprising generating a prediction of said surface profile from said final model and said plurality of parameters.

5 11. The method of claim 1, wherein said plurality of parameters comprises: a plurality of unknown substrate parameters and a plurality of unknown reactor parameters.

10 12. The method of claim 11, wherein said plurality of unknown substrate parameters comprises: a dimension of a substrate, a substrate composition, and a distribution of a feature on a surface substrate.

15 13. The method of claim 11, wherein said plurality of unknown reactor parameters comprises: a power level, a gas temperature, a gas pressure, a gas flow, and a gas composition.

14. The method of claim 1, wherein said plurality of parameters varies with time.

20 15. A method for configuring an apparatus for calibrating a semi-empirical process simulator, the method comprising the steps of:

deriving a set of test conditions for which a profile evolution is governed only by a limited number of parameters;

selecting a plurality of test values for each said set of test conditions;

subjecting a test substrate to a test process defined by said plurality of test

5 values, thereby creating a test surface profile;

generating an approximate profile prediction from said plurality of test values;

adjusting said plurality of test values to minimize a discrepancy between said test surface profile and said approximate profile prediction, thereby solving 10 for said limited number of parameters; and

repeating said selecting, subjecting, generating, and revising for another said set of test conditions until said plurality of parameters is determined, thereby providing a final model of said profile evolution in terms said plurality of parameters.

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16. An apparatus for calibrating a semi-empirical process simulator, the apparatus comprising:

a computer memory for storing a desired surface profile;

a computer memory for storing a test surface profile, created by subjecting

20 a test substrate to a test process defined by a respective plurality of parameters;

means for deriving a set of test conditions for which a profile evolution is governed only by a limited number of parameters;

means for selecting a plurality of test values for each said set of test conditions;

means for subjecting a test substrate to a test process defined by said plurality of test values, thereby creating a test surface profile;

5 means for generating an approximate profile prediction from said plurality of test values;

means for revising said plurality of test values to minimize a discrepancy between said test surface profile and said approximate profile prediction, thereby solving for said limited number of parameters; and

10 means for repeating said selecting, subjecting, generating, and revising for another said set of test conditions until said plurality of parameters is determined, thereby providing a final model of said profile evolution in terms said plurality of parameters.

15 17. The apparatus of claim 16, further comprising a computer memory for storing a preliminary test value, the means for generating an approximate profile description from the initial surface profile model and the respective test value employing the preliminary test value.

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18. A program storage device readable by a machine, tangibly embodying a program of instructions readable by the machine to perform a method for calibrating a semi-empirical process simulator, the method comprising:  
deriving a set of test conditions for which a profile evolution is governed  
5 only by a limited number of parameters;  
selecting a plurality of test values for each said set of test conditions;  
subjecting a test substrate to a test process defined by said plurality of test  
values, thereby creating a test surface profile;  
generating an approximate profile prediction from said plurality of test  
10 values;  
adjusting said plurality of test values to minimize a discrepancy between  
said test surface profile and said approximate profile prediction, thereby solving  
for said limited number of parameters; and  
repeating said selecting, subjecting, generating, and adjusting for another  
15 said set of test conditions until said plurality of parameters is determined, thereby  
providing a final model of said profile evolution in terms said plurality of  
parameters.

19. A program storage device readable by a machine, tangibly embodying a  
20 program of instructions readable by the machine to perform a method for  
configuring an apparatus for calibrating a semi-empirical process simulator,  
the method comprising:

deriving a set of test conditions for which a profile evolution is governed only by a limited number of parameters;

selecting a plurality of test values for each said set of test conditions;

subjecting a test substrate to a test process defined by said plurality of test

5 values, thereby creating a test surface profile;

generating an approximate profile prediction from said plurality of test values;

adjusting said plurality of test values to minimize a discrepancy between said test surface profile and said approximate profile prediction, thereby solving

10 for said limited number of parameters; and

repeating said selecting, subjecting, generating, and revising for another said set of test conditions until said plurality of parameters is determined, thereby providing a final model of said profile evolution in terms said plurality of parameters.

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